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HSDPA/ HSUPA HANDBOOK

Edited by
Borko Furht
Syed A. Ahson



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Preface

Mobile users are demanding higher data rates and higher-quality mobile communication services. The 3rd Generation Mobile Communication System is an outstanding success. The conflict of rapidly growing numbers of users and limited bandwidth resources requires that the spectrum efficiency of mobile communication systems be improved by adopting some advanced technologies. It has been proven, both in theory and in practice, that some novel key technologies such as MIMO (multi-input, multi-output) and OFDM (orthogonal frequency division multiplexing) improve the performance of current mobile communication systems. Many countries and organizations are researching next-generation mobile communication system, including the ITU (International Telecommunication Union), European Commission FP (Framework Programme), WWRF (Wireless World Research Forum), Korean NGMC (Next Generation Mobile Committee), Japanese MITF (Mobile IT Forum), and China Communication Standardization Association (CCSA). International standards organizations are working for standardization of the E3G (Enhanced 3G) and 4G (4th Generation Mobile Communication System), such as the LTE (Long Term Evolution) plan of the 3GPP (3rd Generation Partnership Project) and the AIE (Air Interface of Evolution)/UMB (Ultra Mobile Broadband) plan of 3GPP2.

The HSDPA (High-Speed Downlink Packet Access) standard was introduced in Release 5 in 2002, followed by the introduction of HSUPA (High-Speed Uplink Packet Access) in Release 6 in 2004. The HSUPA and HSDPA are combined under the same standard and known as the HSPA standard. HSDPA is an enhancement of UMTS (Universal Mobile Telecommunications System) networks that supports data rates of several megabits per second (Mbps), making it suitable for data applications ranging from file transfer to multimedia streaming. The introduction of High-Speed Packet Access (HSPA) greatly improves the achievable bit rate. HSDPA has been standardized as an extension of the UMTS as a part of the 3GPP Release 5. It is

spectrally the most efficient WCDMA (Wideband Code Division Multiple Access) system commercially available at the moment.

UMTS networks that are currently offering both legacy and HSDPA/HSPA services have upgraded their UTRAN (UMTS Terrestrial Radio Access Network) functionalities based on the Release 5/6 or higher 3GPP standard. The new standard supports both legacy services as well as advanced packet-based HSPA services. Introduction of HSDPA and HSUPA services has increased the packet-switched traffic volume in the UTRAN and in the core network (CN). The UTRAN architecture is currently evolving toward a high data rate and high QoS (Quality of Service) network. Recently, the E-UTRAN (Evolved UTRAN) architecture has been introduced and was designed to support advanced packet-switched services using a flat network architecture to accommodate new services as well as to offer high QoS to all services.

This book provides technical information about all aspects of HSPA technology. The areas covered range from basic concepts to research-grade material, including future directions. This book captures the current state of HSPA technology and serves as a source of comprehensive reference material on this subject. It has a total of 13 chapters authored by 30 experts from around the world. The targeted audience for this Handbook includes professionals who are designers and/or planners for HSPA systems, researchers (faculty members and graduate students), and those who would like to learn about this field.

The book is expected to have the following specific salient features:

- To serve as a single comprehensive source of information and as reference material on HSPA technology
- To deal with an important and timely topic of emerging technology of today, tomorrow, and beyond
- To present accurate, up-to-date information on a broad range of topics related to HSPA technology
- To present the material authored by the experts in the field
- To present the information in an organized and well-structured manner

Although the book is not precisely a textbook, it can certainly be used as a textbook for graduate courses and research-oriented courses that deal with HSPA. Any comments from the readers will be highly appreciated.

Many people have contributed to this Handbook in their unique ways. The first and foremost group that deserves immense gratitude is the group of highly talented and skilled researchers who have contributed 13 chapters to this Handbook. All of them have been extremely cooperative and professional. It has also been a pleasure to work with Rich O' Hanley, Amy

Blalock, and Kari Budyk of CRC Press, and we are extremely grateful for their support and professionalism. Our families have extended their unconditional love and strong support throughout this project, and they all deserve very special thanks.

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Borko Furht is a professor and chairman of the Department of Computer Science and Engineering at Florida Atlantic University (FAU) in Boca Raton, Florida. He is also Director of the NSF-sponsored Industry/University Cooperative Research Center at FAU. Before joining FAU, he was a vice president of research and a senior director of development at Modcomp (Fort Lauderdale, Florida), a computer company of Daimler Benz, Germany; a professor at the University of Miami in Coral Gables, Florida; and a senior researcher in the Institute Boris Kidric-Vinca, Yugoslavia. Borko received a Ph.D. degree in Electrical and Computer Engineering from the University of Belgrade. His current research is in multimedia systems, video coding and compression, 3D video and image systems, video databases, wireless multimedia, and Internet computing. He has been Principal Investigator and Co-Principal Investigator of several multiyear, multimillion dollar projects—on Coastline Security Technologies, funded by the Department of Navy, One Pass to Production, funded by Motorola, and NSF PIRE project on Global Living Laboratory for Cyber Infrastructure Application Enablement, and NSF High-Performance Computing Project. He is the author of numerous books and articles in the areas of multimedia, computer architecture, real-time computing, and operating systems. He is a founder and editor-in-chief of *the Journal of Multimedia Tools and Applications* (Springer). He has received several technical and publishing awards, has consulted for many high-tech companies including IBM, Hewlett-Packard, Xerox, General Electric, JPL, NASA, Honeywell, and RCA, and has been an expert witness for Cisco and Qualcomm. He has also served as a consultant to various colleges and universities. He has given many invited talks, keynote lectures, seminars, and tutorials, and also has served on the board of directors of several high-tech companies.

Syed Ahson is a Senior Software Design Engineer with Microsoft Corporation (Redmond, Washington). As part of the Mobile Voice and Partner Services group, he is busy creating new and exciting end-to-end mobile services and applications. Prior to Microsoft, Syed was a Senior Staff Software Engineer with Motorola, where he contributed significantly in leading roles toward the creation of several iDEN, CDMA, and GSM cellular phones. Syed has extensive experience with wireless data protocols, wireless data applications, and cellular telephony protocols. Prior to joining Motorola, Syed was a Senior Software Design Engineer with NetSpeak Corporation (now part of Net2Phone), a pioneer in VoIP telephony software.

Syed has published more than ten books on emerging technologies such as WiMAX, RFID, Mobile Broadcasting, and IP Multimedia Subsystem. His recent books include *IP Multimedia Subsystem Handbook* and *Handbook of Mobile Broadcasting: DVB-H, DMB, ISDB-T and MediaFLO*. Syed has authored several research articles and teaches computer engineering courses as an adjunct faculty member at Florida Atlantic University (Boca Raton, Florida) where he introduced a course on Smartphone technology and applications. Syed received his M.S. degree in Computer Engineering in 1998 from Florida Atlantic University, and his B.Sc. degree in Electrical Engineering from Aligarh University, India, in 1995.

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